CLAIMS

What is claimed is:

1. A spin valve sensor comprising:

a ferromagnetic free layer structure;

a ferromagnetic pinned layer structure;

a nonmagnetic spacer layer located between the free layer structure and the pinned layer structure; and

a capping layer structure including a refractory metal layer and a silicon layer, wherein the refractory metal layer is disposed between the free layer structure and the silicon layer.

2. The spin valve sensor of Claim 1, wherein the refractory metal layer is selected from a group consisting of ruthenium and molybdenum.

3. The spin valve sensor of Claim 1, wherein the refractory metal layer has a thickness in a range of 5Å to 30Å and the silicon layer has a thickness in a range of 5Å to 30Å.

4. The spin valve sensor of Claim 1, wherein the refractory metal layer has a thickness of approximately 15Å and the silicon layer has a thickness of approximately 15Å.

5. The spin valve sensor of Claim 1, further comprising a protective metal layer interfacing the free layer structure and disposed between the refractory metal layer and the free layer structure.

6. The spin valve sensor of Claim 5, wherein the protective metal layer is formed from tantalum.

7. The spin valve sensor of Claim 5, wherein the protective metal layer has a thickness in a range of 25Å to 50Å.

8. The spin valve sensor of Claim 1, wherein a silicide is formed between the refractory metal layer and the silicon layer.

9. The spin valve sensor of Claim 1, wherein the pinned layer structure is a self-pinned pinned layer structure that comprises:

a first ferromagnetic pinned layer and a second ferromagnetic pinned layer, wherein the first ferromagnetic pinned layer is pinned in a first direction and the second ferromagnetic pinned layer is pinned in second direction that is antiparallel to the first direction; and

a coupling layer located between the first ferromagnetic pinned layer and the second ferromagnetic pinned layer.

10. The spin valve sensor of Claim 1, wherein the free layer structure is located between the spacer layer and the capping layer structure.

11. An apparatus comprising a spin valve sensor, the spin valve sensor comprising:

a ferromagnetic free layer structure;

a ferromagnetic pinned layer structure;

a nonmagnetic electrically conductive spacer layer located between the free layer structure and the pinned layer structure; and

a capping layer structure comprising a first capping layer and a second capping layer, the first capping layer located between the second capping layer and the pinned layer structure, the first capping layer interfacing with the second capping layer to form a silicide that provides a compressive stress on the pinned layer structure.

12. The apparatus of Claim 11, wherein the first capping layer is formed from a refractory metal.

13. The apparatus of Claim 12, wherein the refractory metal is selected from a group consisting of ruthenium and molybdenum.

14. The apparatus of Claim 12, wherein the refractory metal layer has a thickness in a range of 5Å to 30Å and the silicon layer has a thickness in a range of 5Å to 30Å.

15. The apparatus of Claim 12, wherein the refractory metal layer has a thickness of approximately 15Å and the silicon layer has a thickness of approximately 15Å.

16. The apparatus of Claim 11, wherein the second capping layer is formed from silicon.

17. The apparatus of Claim 11, wherein the spin valve sensor further comprises a protective metal layer disposed between the first capping layer and the pinned layer structure.

18. The apparatus of Claim 17, wherein the protective metal layer interfaces the free layer structure and the first capping layer interfaces the protective metal layer.

19. The apparatus of Claim 11, wherein free layer structure is located between the pinned layer structure and the capping layer structure.

20. The apparatus of Claim 11, wherein the apparatus is a magnetic head assembly.

21. A method of making a spin valve sensor for a magnetic head assembly, the method comprising:

forming a pinned layer structure;

forming a nonmagnetic electrically conductive spacer layer on the pinned layer structure;

forming a ferromagnetic free layer structure on the spacer layer; and

forming a capping layer structure, wherein forming a capping layer structure comprises:

forming a first capping layer of a refractory metal; and

forming a second capping layer of silicon on the first capping layer, wherein the first capping layer is located between the pinned layer structure and the second capping layer structure, wherein a silicide is formed at the junction of the first capping layer and the second capping layer.

22. The method of Claim 21, further comprising forming a protective metal layer located between the first capping layer and the free layer structure.

23. The method of Claim 22, wherein the protective metal layer is formed from tantalum.

24. The method of Claim 21, wherein the refractory metal is selected from a group consisting of ruthenium and molybdenum.

25. The method of Claim 21, wherein the first capping layer is formed with a thickness in the range of 5Å to 30Å and the second capping layer is formed with a thickness in the range of 5Å to 30Å.